**7 Notes ENERGY**

**E = mc2** the combination of matter and energy makes up the universe. (Matter is condensed energy. **Matter** is substance, energy is transfer; e-m waves from sun

**Work** = force X distance; object must be moved in the same direction as applied force-through a distance or no work;

Work involves a transfer of energy; Work = 1 N-m = 1 Joule

Work is not a form of energy, but a way to transferring energy from one place to another.

1. Work done against another force- lift against gravity or bow
2. A change in speed of the object

**Power =** work/time; = Joule/sec (J/s); = 1 Watt; 745.6 W = 1 HP = ¾ of Kwatt

**Energy**- Measured in Joules; forms KE, PE, chemical, nuclear, sound, light, measured in temp (KE) as electrical charge for voltage in PE & KE, Vibration in waves/motion of electrons.

**Mechanical Energy-** due to position or movement; forms- PE or KE or sum of 2

**Potential Energy**- stored energy due to position; spring, chemical (food, batteries, fossil fuels)

**Gravitational potential energy-** due to elevation (pile driver or water tower)

PE = m g h (gravitational potential energy = weight X height); {remember w = mg}

**Kinetic energy** = a change in energy; motion**; KE = ½ mv2**; or FD = ½ mv2; W = F X D: J = J; W = ½ mv2; F X D = KE;

**Work- Energy Theorem**; work = ∆KE (Net work = change in KE:

* KE depends on speed squared; double the speed of car, takes 4 times distance to stop.
* Some of work is lost as heat due to friction; decreasing the efficiency. If force of friction is equal and opposite to the push, the net force on the object is zero and no net work is done. No change in KE.
* Hybrid cars absorb energy from braking and store it in electrical storage batteries

**Conservation of Energy-** Taking heat energy into account, we find energy transforms without net loss or net gain. Energy cannot be created or destroyed; it may be transformed from one form into another, but the total amount of energy never changes.

Atoms are concentrated bundles of energy- ex. thermonuclear fusion / suns energy🡪 plants 🡪 fossil fuels 🡪 electricity 🡪 heating/cooling/cooking/electric car

**Machines**- device for multiplying or changing direction of force (lever/pulley)

* Work input = work output or (f X d )input = ( f X d ) output
* Fulcrum- point on lever where support is balanced. Lever can increase force at expense of distance.
* No 100% efficient machines. No machine can multiply work or multiply energy. (some lost as heat due to friction or to molecular motion)
* No machine or device can put out more energy than is put into it; it can only transfer energy or transform it from one form to another.

Efficiency = useful energy output/total energy input. ( most energy lost is in form of heat/thermal energy)

Compare KE & Momentum-

* Momentum is vector; Energy – is scalar
* During collisions- 2 objects with same momentum may collide & have zero resultant momentum & will stop at point of impact, but the KE of objects are added. The force of impact on both objects is the same.

Energy for life- sunlight is absorbed by plants and begins the food chain. It only passes on 10% of the energy to the next trophic level.

* Sources of Energy- source of energy on earth is the sun (except for nuclear and geothermal power)
* Alternative energy sources- due to sun (wind, hydroelectric, )
* Geothermal- dry rock- water circulates through rock heated from volcanic origins